

A Robust clustering Method for Multispectral Remote Sensing Image Analysis

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ABSTRACT

Methods of Detection of Multi spectral remote sensing Images are becoming more popular due to the progresses in spatial resolution of satellite imagery. This paper presents detection of multispectral remote-sensing images corrupted by noise using robust clustering method without any training data. First enhancement of color separation of satellite image using decorrelation stretching is carried out and then the regions are grouped into a set of clusters. Simulation results are provided to demonstrate the efficacy of the proposed method for detection of Multi spectral remote sensing Images.

Keywords: Decorrelation, LANDSAT imagery, Spatial resolution, Support Vector Machines.

1. INTRODUCTION

The process of image segmentation (such as pixel based, contour based, region based, model based, color based and hybrid, etc.) is defined as the search for homogenous regions in an image and later the classification of these regions. It also means the partitioning of an image into meaningful regions based on homogeneity or heterogeneity criteria [1]. Multispectral image delivers a great source of data for studying spatial and temporal changeability of the environmental factors. It can be utilized in a number of applications which consists of reconnaissance, making of mapping products for military and civil use, assessment of environmental damage, nursing of land use, radiation level check, urban planning, growth directive, soil test and crop outcome increment . One major area where we use multispectral image is in the process of classification and mapping of vegetation over large spatial scales, as the remote sensing data delivers very good coverage, mapping and classification of land cover features like vegetation, soil, water and forests. This behaves like a replacement for the normal classification techniques, which necessitates expensive and time-intensive field surveys.

Purposes of classification of LANDSAT images is to identify Land use and land cover (LULC) Vegetation types, Geologic terrains, Mineral exploration, Alteration mapping, etc. LANDSAT 7 was launched in April, 1999. LANDSAT carries two multispectral sensors. The first is the Multi-Spectral Scanner (MSS) which acquires imagery in four Spectral bands: blue, green, red and near infrared. The second is the Thematic Mapper (TM) which collects seven bands: blue, green, red, near-infrared, two mid- infrared and one thermal infrared. The MSS has a spatial resolution of 80 meters, while that of the TM is 30 meters. Both sensors image a 185 km wide swath, passing over each day at 09:45 local time, and returning every 16 days. With LANDSAT 7, support for TM, imagery is to be continued with the addition of a co-registered 15 m panchromatic band [4].

Multispectral image classification can be considered as a combined project of both image processing and classification methods. Usually, image classification, in the process of remote sensing is the method of referring pixels or the basic units of an image to the classes. It is mostly likely to create groups of similar pixels found in image data into classes that match the informational categories of user interest by matching the pixels to one another and to those of the said

identity. Many techniques of image classification have been introduced and numerous areas like image analysis and pattern recognition use the vital term, classification.

Image segmentation is a process of partitioning image pixels based on selected image features. The pixels that belong to the same region must be spatially connected and have the similar image features. If the selected segmentation feature is color, an image segmentation process would separate pixels that have distinct color feature into different regions, and, simultaneously, group pixels that are spatially connected and have the similar color into the same region.

Classification of multispectral remotely sensed data is computed with a special attention on uncertainty computation in the land-cover maps. An efficient technique for classifying the multispectral satellite images into land cover and land use sectors using SVM. The proposed classification technique comprises of segmentation using clustering technique, training data selection for SVM and classification using trained SVM. Multispectral images cannot be fed directly into the SVM for training and testing. The input image is subjected to a set of pre-processing so that the image gets transformed suitably for segmentation.

This paper deals with statistical cluster analysis in the potential presence of contaminations. Detection of multispectral remote-sensing images corrupted by noise using Support Vector Machines is proposed in this paper.. Simulation results are provided to demonstrate the effectiveness of proposed algorithm.

II. PROPOSED K-MEANS CENTRE BASED CLUSTERING

Define a d-dimensional set of n data points $X = \{x_1, x_2, \dots, x_n\}$ as the data to be clustered and a d-dimensional set of k centers $C = \{c_1, c_2, \dots, c_k\}$ as the clustering solution that an iterative algorithm refines. Now we can define the steps of a general model of iterative, center-based clustering as [6]

1. Initialize the algorithm with guessed centers C.
2. For each data point x_i , compute its membership $m(c_j | x_i)$ in each center c_j nad its weight $w(x_i)$.

3. For each center c_j recompute its location from all data points x_i according to their memberships and weights:

$$c_j = \frac{\sum_{i=1}^n m(c_j | x_i) w(x_i) x_i}{\sum_{i=1}^n m(c_j | x_i) w(x_i)}$$

4. Repeat steps 2 and 3 until convergence.
5. Further, the entire process can be summarized in the following steps

Step 1: Read the image

Step 2: For color separation of an image apply the Decorrelation stretching.

Step 3: Convert Image from RGB Color Space to L*a*b* Color Space.

Step 4: Classify the Colors in 'a*b*' Space Using proposed K-Means Clustering.

Step 5: Label Every Pixel in the Image Using the Results from K-MEANS.

Step 6: Create Images that Segment the Image by Color.

Step 7: Segment the Nuclei into a Separate Image.

Furthermore, the k-means algorithm partitions data into k disjoint subsets or clusters with common characteristics. The solution is then a set of k-centers, each of which is located at the centroid of the data for which it is the closest center. The objective function that the k-means algorithm optimizes, i.e., the classical least squares (LS) technique uses the solution corresponding to

$$\sum_{i=1}^n \min_{j \in \{1, \dots, k\}} \|x_i - c_j\|^2 \quad (1)$$

or

$$\min_c \sum_{i=1}^N r_i^2 \quad (2)$$

It was realized that the LS technique is extremely sensitive to noise and outliers. Therefore many robust methods were developed in statistics to overcome this [7-9].

III. SIMULATION RESULTS

Various experiments were carried out using K-means clustering based image analysis for LANDSAT images and results are summarized in Fig1 to Fig 4. In Fig 5, error analysis of the proposed SVM method is shown and these results demonstrate that multispectral remote sensing image corrupted with noise analysis can be carried out with to maximum accuracy.

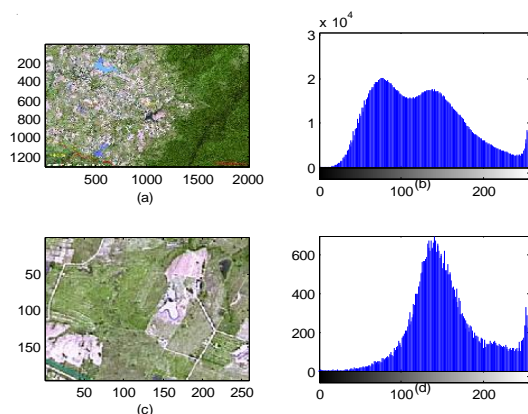


Fig.1 (a) & (b) Original Image & its Histogram, Fig.1 (c) & (d) Decoorelated Image & its Histogram

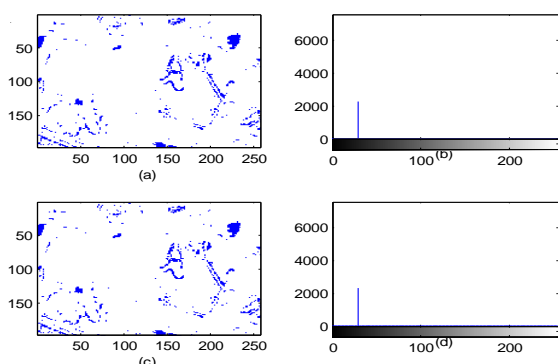


Fig.2 (a) & (b) Objects in cluster 1 (multi spectral remote sensing Image without noise is considered) & its Histogram, Fig.2 (c) & (d) Objects in cluster 1 (multi spectral remote sensing Image with noise is considered) & its Histogram.

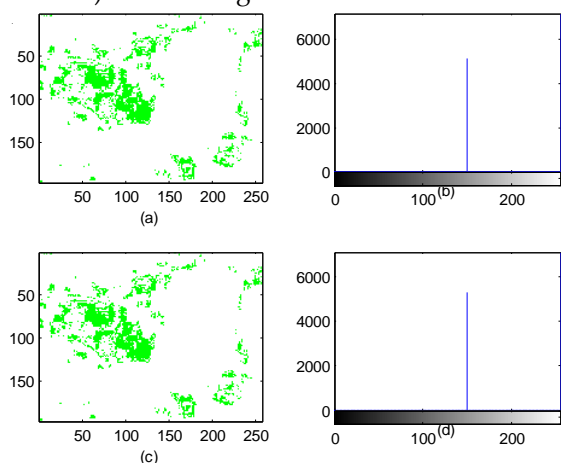


Fig. 3 (a) & (b) Objects in cluster 2 (multi spectral remote sensing Image without noise is considered) & its Histogram, Fig. 3 (c) & (d) Objects in cluster 2 (multi spectral remote sensing Image with noise is considered) & its Histogram.

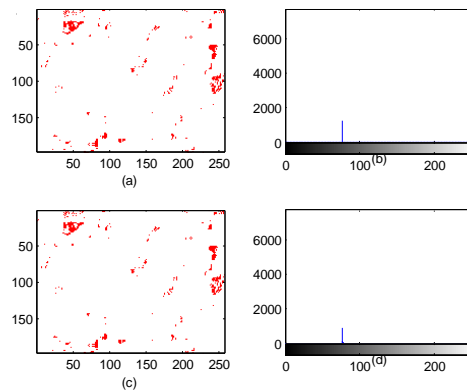


Fig. 4 (a) & (b) Objects in cluster 3 (multi spectral remote sensing Image without noise is considered) & its Histogram, Fig. 4 (c) & (d) Objects in cluster 3 (multi spectral remote sensing Image with noise is considered) & its Histogram.

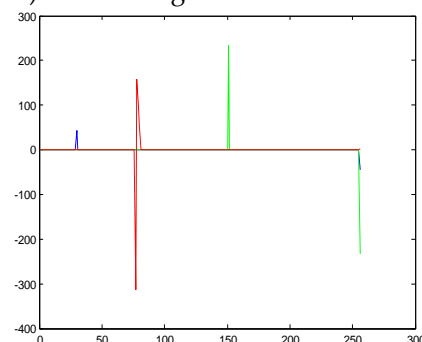


Fig5. Error Analysis for the considered 3 clusters (Blue, Green, Red indicates cluster 1, cluster 2 and cluster3, respectively).

IV. CONCLUDING REMARKS

In this paper, robust clustering based algorithm for detection of Multi Spectral Remote sensing Images corrupted with noise is proposed analyzed. Simulation results are also provided, which demonstrate the efficiency of proposed algorithm for image analysis for extracting and updating geographical information though considered LANDSAT Images are corrupted with noise

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